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12. Proposed by H. W. DRAUGHON, Clinton, Louisiana.

Find three numbers such that, the sum of their cubes may be a square, and the sum of their squares a cube.

Solution by ARTEMAS MARTIN, LL.D., U. S. Coast and Geodetic Survey Office, Washington, D. C.

Let ax , bx and cx denote the numbers; then $(a^3 + b^3 + c^3)x^3 = \square \dots \dots (1)$,
 $(a^2 + b^2 + c^2)x^2 = \text{cube}, = v^3$ say $\dots \dots (2)$ and we have $x = a^2 + b^2 + c^2$.

Substituting in (1), after expunging x^2 , $(a^2 + b^2 + c^2)(a^3 + b^3 + c^3) = \square \dots \dots (3)$.

Let $mv = a$, $nv = b$, $pv = c$; then (3) becomes

$$(m^2 + n^2 + p^2)(m^3 + n^3 + p^3)v = \square, = v^2 \text{ say, after rejecting } v^4; \text{ whence}$$

$$v = (m^2 + n^2 + p^2)(m^3 + n^3 + p^3).$$

$$\therefore a = m(m^2 + n^2 + p^2)(m^3 + n^3 + p^3),$$

$$b = n(m^2 + n^2 + p^2)(m^3 + n^3 + p^3),$$

$$c = p(m^2 + n^2 + p^2)(m^3 + n^3 + p^3);$$

$$\text{and } x = a^2 + b^2 + c^2 = (m^2 + n^2 + p^2)^3(m^3 + n^3 + p^3)^2.$$

$$\text{Hence } ax = m(m^2 + n^2 + p^2)^4(m^3 + n^3 + p^3)^3,$$

$$bx = n(m^2 + n^2 + p^2)^4(m^3 + n^3 + p^3)^3,$$

$$cx = p(m^2 + n^2 + p^2)^4(m^3 + n^3 + p^3)^3.$$

If $m = 1$, $n = 2$, $p = 3$, the numbers are, after dividing out the 6th power factor 6^6 , 38416, 76832 and 115248.

Also solved by H. W. DRAUGHON, F. P. MATZ, and G. B. M. ZERR.

PROBLEMS.

18. Proposed by Professor G. B. M. ZERR, A. M., Principal of Schools, Staunton, Virginia.

Decompose into the sum of two squares the number $17^3 \cdot 73^5$.

19. Proposed by ARTEMAS MARTIN, LL. D., U. S. Coast and Geodetic Survey Office, Washington, D. C.

Find three positive integer numbers whose sum is a cube, and, also, the sum of any two diminished by the third a cube.



AVERAGE AND PROBABILITY.

Conducted by B. F. FINKEL, Kidder, Mo. All contributions to this department should be sent to him.

SOLUTIONS TO PROBLEMS.

5. Proposed by DE VOLSON WOOD, M. A., C. E., Professor of Mechanical Engineering, Stevens Institute of Technology, Hoboken, New Jersey.

An actual case suggested the following:

An equal number of white and black balls of equal size are thrown into a rec-